Appendix I

Barriers to Making Improvements to Reduce Energy or Conserve Water as Reported in 1998

Growers willingness to investigate or consider resource conservation improvements varies across the western states. In addition, the amount of irrigated acreage (and the amount of irrigation water) that has (or has not) been associated with resource conservation efforts varies across the western states. This section is based upon data contained in the 1998 Census of Agriculture, Table 39. Appendix Tables I-1 and I-2 was prepared using data in the 1998 Census.

Appendix Tables I-1 and I-2 shows, given that growers have investigated possible improvements, there remain barriers to the adoption of more efficient resource use techniques/technologies. These barriers are not mutually exclusive, but have been separated into two broad areas: 1) barriers having to do primarily with the use of water; and, 2) barriers that can impact on both water conservation and the more efficient use of energy.

Appendix Table I-2 also shows (across the bottom of the table) how, in the perception of the authors of this report, significantly increased energy costs would probably affect the grower responses shown in the original data. The direction of possible change is also valid for each state's percentage of irrigated acreage associated with a particular barrier. Given higher energy costs, additional conditions under which a direction of change might occur are also provided. Appendix Table I-2 is summarized below in Table I-1

Table I-2

Barriers to Making Improvements to Reduce Energy or Conserve Water as Reported in 1998, and Directions of Possible Change

Barrier	Percentage of Growers Reporting by State				Percentage of Irrigated Acreage by State				Direction of Change, given higher energy costs occur
	CA	OR	NV	AZ	CA	OR	NV	AZ	
Have not investigated improvements	29	63	20	55	31	36	33	26	decrease, assuming that farming continues
Barriers associated with use of water									
Risk of reduced yield or poor quality product	34	4	20	10	38	23	26	26	not change
Physical conditions limit effectiveness	13	24	10	10	51	44	55	29	not change
Uncertain about water rights	14	21	30	5	38	40	25	23	increase, assuming that discussions about water rights continues at state and national levels
Barriers associated with energy and water use									
Improvements not cost effective	44	21	40	25	77	66	56	66	decrease, assuming that energy and water costs increase
Cannot finance improvements	24	34	40	25	55	64	59	71	increase, assuming farming continues and farm economy remains stagnate
Landlord will not share in costs	3	1	10	10	26	11	10	47	decrease, assuming farming continues
Will not be farming long enough to justify improvements	17	9	20	10	18	11	18	35	increase, assuming that farm economy remains stagnate

Since California and Arizona have been, for quite some time, areas of relatively higher energy costs and higher water costs, agricultural producers have been very sensitive to the need to operate as efficiently as possible. This stated, the percentages of California and Arizona growers who suggested they had not investigated improvements seems high - until it is realized that many efficiency measures were incorporated in irrigation systems as the systems were first installed. This is suggested by the 55 percent of Arizona farmers who reported that they had not investigated improvements, yet farm in an area of the country noted for its desert environment and relatively scarce and costly water. Eighty percent of Nevada farmers, representing 67 percent of the state's irrigated acreage, reported that they had investigated improvements. These investigations probably related more to water use efficiencies than energy use efficiencies, since electric energy costs to growers in Nevada have been relatively low, as compared with California and Arizona.

In the case of Oregon, it likely that surface water and ground water are generally

more available to agricultural producers than in California, Nevada, or Arizona. Because of rainfall, there is also less reliance on surface and ground water in the western parts of Oregon than in other western states. These water-related factors, coupled with much less expensive electric energy, have enabled Oregon farmers to focus upon other cost elements (e.g., feed or fertilizer) as they seek to remain competitive.

Barriers associated directly with the availability of water and the efficient use of water impact each of the four western states differently. Thirty percent of Nevada growers are concerned with water rights, while only 5 percent are in Arizona. The risk of lower yields or reduced quality because of the lack of irrigation water is more important in CA than in the other three states (perhaps because of the much larger number of specialty crops grown in California).

Physical field or crop conditions limiting system improvements about twice as important in Oregon than in California, Nevada, or Arizona. Generally, the more efficient use of water (e.g., changing from gravity to sprinkler delivery systems) results in higher energy use per acre-foot of water delivered. Green, et al, suggest that "…the method of water application is only one of the many inputs and constraints in agricultural production. California's highly diverse topography, soil types and variety of crops influence irrigation technology choices." In a related study, Dillon, et al, suggest that the installation of more efficient water application technologies is often linked to optimal fertilizer management techniques.

Growers in the four western states must also deal with the remaining barriers. These barriers probably apply to both water and energy conservation issues. The first three barriers are financial in nature. The importance of these factors varies across the four western states. In California and Nevada, for example, 40 percent or more of growers reported that possible improvements would not reduce costs enough to pay for the possible improvements. Twenty-four and 40 percent, respectively, of growers in these two states reported that they could not get financing to make improvements. However, It was not clear from the original census data whether the availability of financing was directly linked to the cost effectiveness of the possible improvement, or not.

The availability of financing is usually much more a function of the overall financial health of the entire agricultural sector, the financial health of a specific agricultural sub-sector, and an individual farmer in particular, than it will be a function of the merits of any particular improvement in efficiency. This is especially the case if the improvements are paid for using cost savings, rather than enhanced revenues.

Agricultural lenders have been operating on a cash flow basis for over two decades and, given the economically depressed farm economy, this is not likely to change.

The fourth barrier, impacting both water use and energy consumption, is particularly noteworthy in regard to overall agricultural policy direction. This barrier, "Will not be farming this place long enough to justify improvements," refers to the length of time that the farmer plans to stay involved with production agriculture. It is not clear from the Census table whether the respondents were leasing the farm ground or owned it.

In any event, the rates at which irrigated acreage may be leaving production agriculture seem staggering. If one assumes a "pay back" period of 7 to 10 years for conservation improvements, then (according to the Census data) a significant, and rapid, decrease in irrigated acreage could occur in the four state region. About 18 percent of California irrigated acreage (639,000 acres), 11 percent of Oregon irrigated acreage (73,000 acres), 18 percent of Nevada irrigated acreage (52,000 acres), and 35 percent of Arizona irrigated acreage (124,000 acres) could leave production agriculture by 2007.

It should be noted that the above decreases in irrigated acreage were shown in agricultural census data that was acquired before the following events occurred:

- The wholesale level electric energy price spikes of summer, 2000, which were said to portend the possibility of high energy costs at the retail level for quite some time. This has been proven true with the recent retail level rate increases granted to the two major utilities serving California agriculture.
- The evolution of the CalFed process, and its possible impact on the availability of water in California. The challenges to agriculture's continued use of water in Oregon, Arizona, and Nevada.
- Increasing urbanization pressures on agricultural land, especially in Arizona and California.
- A generally slowed, if not depressed, agricultural economy in 1999, 2000 and 2001.

The acreage which can be expected to be under the greatest pressure for conversion to non-agricultural uses is that which is within a 15-25 mile radius of larger cities and has easy access to highways. From an overall resource availability standpoint, the only positive aspects to the above are:

- More surface water may be made available to urban and other users as irrigated agricultural ground leaves production

- Electric power, formerly used for water pumping and irrigation, will be "freed up" for use by industrial, commercial, and residential customers. Growers have learned to avoid peak hours whenever possible, so actual peak hour electric power availability would not be expected to increase significantly. But there should be a small increase overall.

With respect to various governmental agencies in California becoming involved directly with growers' willingness to overcome the above mentioned barriers, the following may be some of the avenues which will be pursued:

- Clarify water rights (type of right and duration) so people who are considering making investments in water and energy efficiencies can do so prudently.
- Clarify land use policy (zoning) so that people can know better how to plan investments.
- Recognize that agriculture is being impacted by a wide variety of forces/factors (including the resource issues of energy and water). While not one of these factors alone will take agricultural land out of production, a combination of these factors has and will continue to do so.
- Provide growers with information on energy and water use efficiencies that are both feasible and financially worthwhile.
- Directly subsidize energy efficiency measures installed by farmers.
- Suggest the reexamination of electricity rate structures applied to agriculture. Be certain the rates contain only cost elements associated with serving production agriculture.
- Recognize that farmers' demand for energy is very price inelastic (farmers cannot respond much, if at all, to price changes). An example of the low price elasticity was provided in a recent San Diego Gas and Electric Company report within which a value of -0.05 was given. Consequently, allowing electricity prices to reach high levels for brief periods will not cause agricultural customers to use much less energy than they had been using...they will be just paying considerably more on their monthly invoices.
- Investigate the feasibility of installing master meters where possible at agricultural locations. In some cases, four or five separate meters could be rolled into one...thus saving monthly customer and meter billing costs for each of the separate meters. This not energy saving, necessarily, but there could be

significant cost savings as far as an agricultural producer is concerned.

Table I-2A
Barriers to Making Improvements to Reduce Energy or Conserve Water as Reported in 1998

Barriers to Making Improvements - Water Conservation

	Total	Percent of state total	Have not investigated improvements	Percent of state total	Risk of reduced yield or poor crop quality	Percent of state total	Physical field/crop conditions limit system improvements	Percent of state total	Uncertain about future water rights	Percent of state total
	(X1,000)		(X1,000)		(X1,000)		(X1,000)		(X1,000)	
State										
California										
Number of farms	29.2	100%	8.6	29%	9.8	34%	3.8	13%	4.1	14%
Acres Irrigated	3626.2	100%	1136.7	31%	1391.1	38%	1832.4	51%	1378.2	38%
Acre feet of water	11495.5	100%	3438.5	30%	4462	39%	5823.8	51%	3988.1	35%
Oregon										
Number of farms	6.7	100%	4.2	63%	0.3	4%	1.6	24%	1.4	21%
Acres Irrigated	685.7	100%	248.2	36%	159.7	23%	304.9	44%	272.9	40%
Acre feet of water	1356.3	100%	458.2	34%	349.3	26%	662.1	49%	564.7	42%
Nevada										
Number of farms	1	100%	0.2	20%	0.2	20%	0.1	10%	0.3	30%
Acres Irrigated	297.2	100%	97	33%	78.3	26%	163.8	55%	75.6	25%
Acre feet of water	744.1	100%	300.7	40%	194.2	26%	394.4	53%	216.7	29%
Arizona										
Number of farms	2	100%	1.1	55%	0.2	10%	0.2	10%	0.1	5%
Acres Irrigated	359.5	100%	94.7	26%	93.3	26%	104.4	29%	83	23%
Acre feet of water	1701.6	100%	392.1	23%	452.7	27%	519.6	31%	323.9	19%
Significantly increased energy costs could cause this percent of state's totals to:				decrease assuming that farming continues		not change		not change		not change

Source:1998 Farm and Ranch Irrigation Survey (1997 Census of Agriculture), Table 33.

Table I-2B
Barriers to Making Improvements to Reduce Energy or Conserve Water as Reported in 1998

Barriers to Making Improvements - Energy Reduction and Water Conservation

	Total	Percent of state total	Improvements will not reduce costs enough to cover installation costs	Percent of state total	Cannot finance improvements	Percent of state total	Landlord will not share in cost	Percent of state total	Will not be farming this place long enough to justify improvements	Percent of state total	Other	Percent of state total
	(X1,000)		(X1,000)		(X1,000)		(X1,000)		(X1,000)		(X1,000)	
State												
California												
Number of farms	29.2	100%	12.8	44%	7	24%	1	3%	4.9	17%	0.9	3%
Acres Irrigated	3626.2	100%	2774.9	77%	1992	55%	949.2	26%	638.5	18%	476.5	13%
Acre feet of water	11495.5	100%	8705.1	76%	6086.1	53%	2912.9	25%	2148.5	19%	1470	13%
Oregon												
Number of farms	6.7	100%	1.4	21%	2.3	34%	0.1	1%	0.6	9%	0.3	4%
Acres Irrigated	685.7	100%	454	66%	441.3	64%	76.7	11%	73	11%	120	18%
Acre feet of water	1356.3	100%	1030.5	76%	1000.9	74%	154.5	11%	146.5	11%	260.7	19%
Nevada												
Number of farms	1	100%	0.4	40%	0.4	40%	0.1	10%	0.2	20%	0.1	10%
Acres Irrigated	297.2	100%	166.2	56%	176.5	59%	29.2	10%	52.3	18%	21.5	7%
Acre feet of water	744.1	100%	471.4	63%	515.3	69%	70.1	9%	176.5	24%	90.1	12%
Arizona												
Number of farms	2	100%	0.5	25%	0.5	25%	0.2	10%	0.2	10%	0.1	5%
Acres Irrigated	359.5	100%	238.1	66%	255.7	71%	167.4	47%	124.2	35%	30.2	8%
Acre feet of water	1701.6	100%	1076.5	63%	976.1	57%	733.5	43%	586	34%	111.4	7%
Significantly increased energy costs could cause this percent of state's totals to:			decrease assuming that cost savings may become available		increase assuming that bottom line will be further eroded		decrease assuming that farming continues		increase assuming that higher costs will hasten departure		not change	